

4.14 UTILITIES AND ENERGY

4.14.1 Water Consumption

Water consumption for the Livermore Site and Site 300 remained relatively constant from 1998 to 2002 (Figure 4.14.1–1). Water consumption at the Livermore Site averaged 214 million gallons over the 5-year period with a standard deviation of 5.5 million gallons. This standard deviation represents a 2.6 percent variation from the average. At Site 300, water consumption averaged 23.8 million gallons over the same 5-year period with a standard deviation of 1.5 million gallons. This standard deviation represents a 6.5 percent variation from the average. The annual average total consumption for both sites was 237.8 million gallons with a standard deviation of 6.8 million gallons. This standard deviation represents a 2.9 percent variation from the average.

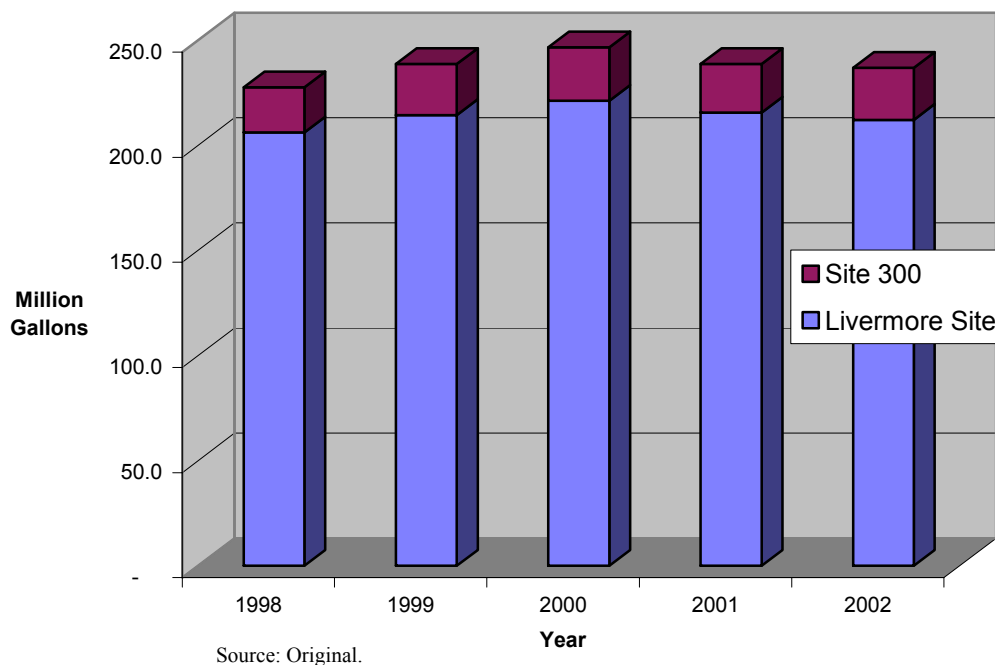


FIGURE 4.14.1–1.—Annual Water Consumption for the Livermore Site and Site 300, 1998 through 2002

Livermore Site

Water for the Livermore Site is provided by three sources (DOE 2003b):

- The primary supply is from the city of San Francisco's Hetch Hetchy water system.
- A backup supply is available from Zone 7 of the Alameda County Flood Control and Water Conservation District.
- Cross-connections exist with the city of Livermore water line for fire protection through a mutual aid agreement (DOE 2003b).

Water consumption rates at the Livermore Site have decreased from an average of 261.8 million gallons per year in 1986, to 212 million gallons per year (581,000 gallons per day) in 2002 (LLNL 2003al, LLNL 2003ce). Currently, peak water usage is approximately 1.2 million gallons per day and is projected to increase to approximately 1.38 million gallons per day as the NIF (110,000 gallons per day) and the Terascale Simulation Facility (60,000 gallons per day) become operational. The capacity of the domestic water system is 2.88 million gallons per day (DOE 2003b).

Site 300

Site 300 is supplied with water from a system of wells. The existing capacity of usable wells is approximately 930,000 gallons per day. A project to connect Site 300 with water pumped from the city of San Francisco's Hetch Hetchy water supply system should be completed by early 2004. The capacity of this new system is estimated to be 648,000 gallons per day, with the capability of expanding to 1.2 million gallons per day (LLNL 2000a).

Site 300 consumed an average of 23.8 million gallons per year (67,900 gallons per day) from 1998 to 2002 (LLNL 2003aq, DOE 2003b). Water consumption rates at Site 300 have remained relatively constant during the past 5 years, but reflect a 22-percent decrease from the 31.8 million gallons per year reported in the 1992 SWEIS (LLNL 1992a).

4.14.2 Electricity Consumption

Electricity consumption for the Livermore Site and Site 300 has remained relatively flat from 1998 to 2000 (Figure 4.14.2-1). Electricity use at the Livermore Site decreased in 1999 and 2000, and increased in 2001 and 2002. Electricity consumption at Site 300 remained relatively constant during the same period.

Electricity consumption at the Livermore Site averaged 321 million kilowatt-hours per year over the 5-year period (1998 to 2002) with a standard deviation of 13.9 million kilowatt-hours. This standard deviation represents a 4.3 percent variation from the average. At Site 300, electricity consumption averaged 16.3 million kilowatt-hours per year over the same 5-year period with a standard deviation of 0.4 million kilowatt-hours. This standard deviation represents a 2.2-percent variation from the average. The total consumption for both sites was 337.3 million kilowatt-

hours per year with a standard deviation of 13.8 million kilowatt-hours. This standard deviation represents a 4.1-percent variation from the average.

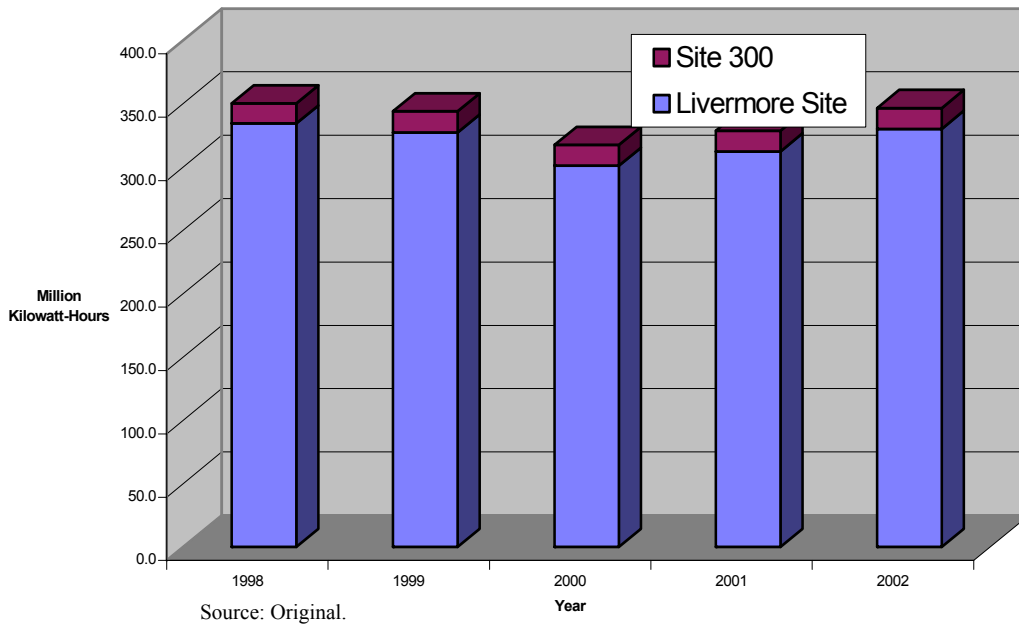


FIGURE 4.14.2–1.—Annual Electricity Consumption for the Livermore Site and Site 300, 1998 through 2002

Livermore Site

Pacific Gas and Electric (PG&E) and the Western Area Power Administration supply electrical power to the Livermore Site. The electrical energy used at the Livermore Site is devoted almost entirely to the operation of office buildings and research laboratory facilities. Under DOE guideline definitions of “building” and “metered process,” Livermore Site space is classified as approximately 50 percent “building” and 50 percent “metered process” load.

Electrical power usage at the Livermore Site declined from about 360 million kilowatt-hours per year in 1990 to about 330 million kilowatt-hours per year in 2002 (LLNL 2003ce). The peak electrical load at the Livermore Site was 57 megawatts in 2002 and is projected to increase to 82 megawatts as the NIF (approximately 12 megawatts), Terascale Simulation Facility (approximately 11 megawatts), and other site projects become operational (DOE 2003b).

Site 300

PG&E supplies electrical power to Site 300. From 1998 to 2002, Site 300 consumed an average of 16.3 million kilowatt-hours per year. Electricity consumption rates at Site 300 have remained stable over the past 5 years, but reflect a 24.9 percent decrease from the 1992 average of 21.75 million kilowatt-hours per year.

The electrical load at Site 300 averages 2.7 megawatts and is projected to increase to 2.8 megawatts as site improvements are completed (LLNL 2000a). The peak electrical load in 2002 was 3.4 megawatts (DOE 2003b).

4.14.3 Fuel Consumption

Livermore Site

Natural Gas

PG&E supplies natural gas to the Livermore Site by way of the meter station at the south end of Southgate drive. Natural gas is used mostly for comfort heating in the building category. In the metered process category, natural gas is used mostly for programmatic experiments and comfort heating. Continuing efforts to decrease energy use include modification to HVAC controls, the design of more efficient buildings, boiler tune-ups, and other site energy conservation efforts.

In 2002, annual natural gas consumption at the Livermore Site totaled 4.7 million therms (12,900 therms per day). Peak consumption in 2002 was 18,700 therms per day and is expected to increase to approximately 23,300 therms per day as the NIF and Terascale Simulation Facility become operational. Natural gas consumption rates at the Livermore Site have remained relatively constant during the past 5 years, but reflect a 27.3 percent increase from the 3.69 million therms per year reported in the 1992 LLNL EIS/EIR (LLNL 1992a). The current capacity of the natural gas system is 24,500 therms per day (DOE 2003b). One therm is equivalent to 100,000 British thermal units.

Diesel Fuel

Diesel fuel is used in vehicles and heavy equipment and for backup electric power generation in the building category. Diesel fuel use averages 72,200 gallons per year (LLNL 2003cf, LLNL 2003cg), a 16.7-percent decrease from the 1992 average of 86,600 gallons per year (LLNL 1992a).

Unleaded Gasoline

At the Livermore Site, unleaded gasoline use averages 451,800 gallons per year (LLNL 2003cf), a 9 percent decrease from the 1992 average of 496,200 gallons per year (LLNL 1992a).

Site 300

At Site 300, fuel oil is used mostly for backup electric power generation in the building category. In the metered process category, fuel oil is used for comfort heating and in some experiments.

Fuel oil consumption at Site 300 averages 16,600 gallons per year (LLNL 2003aq), a 79-percent decrease from the 1992 average of 78,100 gallons per year (LLNL 1992a). This substantial decrease in fuel oil consumption is primarily due to completion of HVAC retrofit and modernization projects.

4.14.4 Sewer Discharges

Livermore Site

The Livermore Water Reclamation Plant (LWRP) handles sewage from the Livermore Site. Sewage flows through two main laterals on the east and west sides of the site, combines in a flow-measuring flume near Building 196 (located at the northwest corner of the Livermore Site), then leaves the site and enters the city of Livermore's sewer system. The western lateral includes wastewater from SNL/CA. From 1998 to 2002, Livermore Site and SNL/CA daily flows averaged a total of 238,500 gallons per day (LLNL 2003l), with a peak of 626,330 gallons per day (DOE 2003b). The Livermore Site portion of the 5-year daily average is approximately 220,400 gallons per day (LLNL 2003a, DOE 2003b). LLNL maintains a sewer diversion facility to protect city of Livermore treatment facilities against accidental contamination. Up to 205,000 gallons of potentially contaminated sewage can be held pending analysis to determine the appropriate handling method (LLNL 2003b).

Sewer discharges at the Livermore Site have remained stable over the past 5 years with small variations in flow (Figure 4.14.4–1). In 2002, sewer discharges attributable to the Livermore Site averaged 216,400 gallons per day (LLNL 2003l). Most discharges to the sanitary sewer system at the Livermore Site are considered batch discharges, since they occur on a sporadic basis. Because these discharges occur randomly and as necessary, there is considerable variation both in the number of discharges per month and in the time of day of the discharges. One exception is the cleaning of cooling towers. Generally, each tower is emptied once a year. This usually occurs during the winter months, when demand on the towers is lower, and on weekends, when more capacity is available in the Livermore Site sewer system.

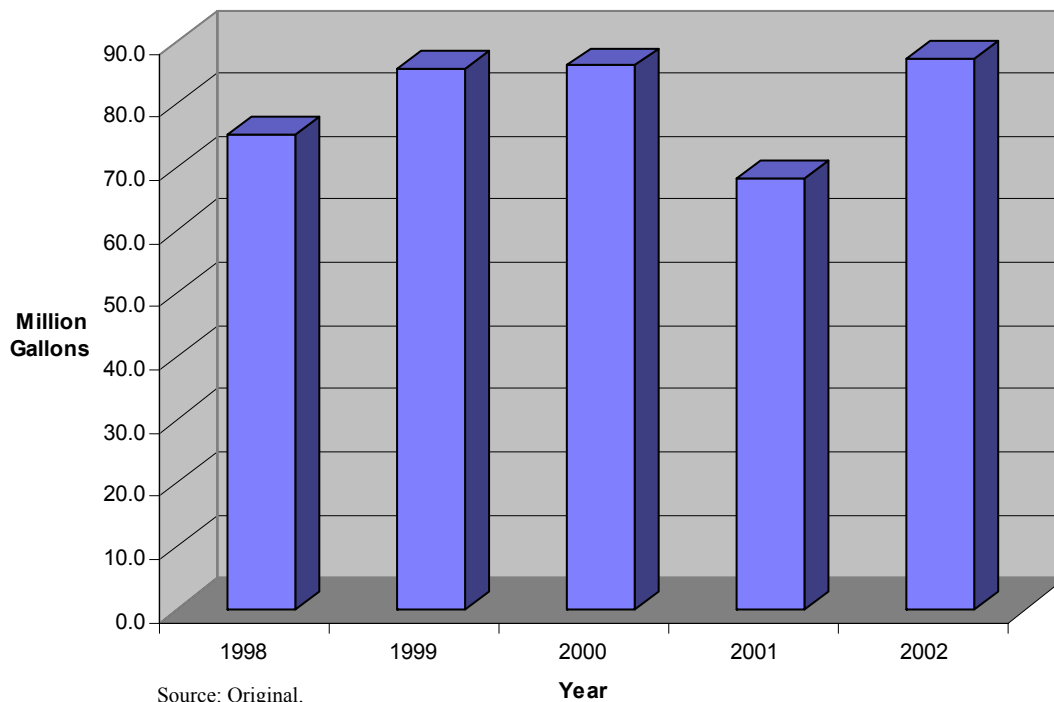


FIGURE 4.14.4-1.—Annual Sewer Discharges for the Livermore Site, 1998 through 2002

There are four principal sources of large-volume batch discharges: air washes, cooling towers, boilers, and wastewater treatment/retention tanks. The amount of releases to the sanitary system varies substantially for each. These four principal sources of large-volume batch discharges are briefly discussed below (LLNL 2000z).

Air Washes

There are 26 building air washes, ranging in capacity from about 4 to 1,500 gallons. Each air wash is cleaned and the water is released to the sanitary sewer once a year at a rate of approximately 15 gallons per minute. Only one air wash is cleaned at a time (LLNL 2000z).

Cooling Towers

There are four active sets of cooling towers at the Livermore Site: three large sets located at U291, U325, and OS683; and one small set at Building 133. The large cooling tower complexes have capacities ranging from 20,000 to 252,000 gallons. The cooling towers are emptied and cleaned on a schedule that ranges from annually to every three years, depending on the tower. Only one tower is cleaned on a given day, and the flow is controlled to release at a rate that will not overflow the sewer-monitoring weir. Unlike other discharges, the cooling towers are generally emptied on weekends and on colder days. The maximum discharge occurs when the largest tower (U235) is cleaned; that discharge includes five cells, totaling approximately 150,000 gallons (LLNL 2000z).

In 1997, a sand filtration system consisting of three filters, each with a separate tank, was installed at the U291 cooling tower. The OS683 cooling tower also has a sand filtration system.

The sand filters are backwashed daily using cooling tower blowdown water. The sand filter backwash is discharged to the sanitary sewer (LLNL 2000z).

Boilers

There are 121 boilers on the Livermore Site: 23 are steam boilers and the remaining 98 are hot water boilers. Only the steam boilers have regular blowdown releases, and eight of the steam boilers have a continuous, rather than batch, blowdown. The remaining 15 steam boilers discharge approximately 5 to 10 gallons, 3 times per week, at a rate of 5 to 6 gallons per minute. Other than the eight continuous discharges, blowdown of the boilers is a manual procedure, and only one boiler is released at a time.

The steam boilers, which hold an average of approximately 1,500 gallons each, are emptied once a year for cleaning. The hot water boilers hold an average of 400 gallons each and are drained every two years (LLNL 2000z).

Wastewater Treatment/Retention Tanks

The Livermore Site has 33 wastewater retention systems, including the liquid waste treatment area and the sewer diversion facility (LLNL 2003l). Each of these systems contains sumps or tanks that can make releases to the sewer if concentrations of the constituents in the system meet discharge limitations; however, the contents of some of the retention systems are never released to the sewer. Most of the retained wastewater is generated at the Livermore Site, but some wastewater is received from Site 300 for treatment or discharge to the sanitary sewer or for disposal as a hazardous waste (LLNL 2000z).

When wastewater is discharged to the sewer system, it combines with other sewage from the Livermore Site and SNL/CA. The combined flow leaves the Livermore Site at Building 196, the Sewage Monitoring Station. The Livermore Site Sewage Monitoring Station is equipped with a continuous monitoring system designed to detect radiation, excessive pH, and metals. To protect the LWRP and to minimize any cleanup that might become necessary, the Livermore Site has an onsite sewage diversion and retention system. This system is capable of containing approximately 205,000 gallons of potentially contaminated sewage until analyses can be completed and appropriate handling methods are determined. This system would contain approximately 6 hours of total discharge from the SNL/CA and Livermore Site facilities. The system ensures that, if the alarm is triggered by the flow, all but the first few minutes of flow is retained at the Livermore Site for evaluation of appropriate treatment for disposal (LLNL 2003l). The city of Livermore has a holding basin into which releases can be diverted for further analysis and disposition. It takes approximately 3 hours for sewage to reach the LWRP from the Livermore Site sewage monitoring station; therefore, the city has adequate time to divert the flow if necessary (LLNL 2000z).

In addition to continuous monitoring of the effluent, sewer samples are collected from both the sewage monitoring station (Building 196) and the LWRP. Samples are analyzed daily for radioactivity and are composited monthly to determine the concentrations of specific isotopes (cesium-137 and plutonium-239) and various metals (LLNL 2000z). Samples are collected quarterly at the point of discharge of specified metal finishing and electrical and electronic

component categorical processes to ensure compliance with wastewater discharge permit limits for those processes. LLNL experienced one permit exceedance from an elevated lead concentration in 2002. The concentrations of all other anions, metals, and organic compounds were well below their respective discharge limits (LLNL 2003I).

The LLNL 2002 Annual Environmental Monitoring Report reports that LLNL is in compliance with all regulations and guidelines governing releases of radioactivity to the sanitary sewer (LLNL 2003I). Since 1992, the concentrations of radionuclides in Livermore Site sewage have steadily declined. The 2002 annual average activity levels of radionuclides in wastewater were 2.3×10^{-5} picocuries per milliliter for cesium-137, 3.5×10^{-6} picocuries per milliliter for plutonium-239, and 0.068 picocuries per milliliter for tritium. A total of 0.02 curies of tritium were released in wastewater during 2002 by LLNL and SNL/CA, representing 0.4 percent of the 10 CFR Part 20 limit. The discharges of plutonium-239 and cesium-137 represented even smaller portions of their respective limits (LLNL 2003I).

Site 300

Site 300 sanitary sewage generated outside the GSA is disposed of through septic tanks and leachfields or cesspools at individual building locations. Sanitary sewage generated at the GSA is piped into an asphalt membrane-lined oxidation pond east of the GSA at an average rate of 2,100 gallons per day (LLNL 2000a).

Wastewater discharges from Site 300 are handled in a variety of ways. In the GSA, wastewater is treated and piped into an asphalt membrane-lined oxidation pond at an average rate of 2,100 gallons per day, with overflow to an evaporation-percolation pond. GSA sewage is domestic in nature. Sanitary sewage generated outside the GSA is disposed of through septic tanks and leach fields or cesspools at individual building locations (LLNL 2000a).

In the process and chemistry areas, industrial wastewater goes through a clarifier and weir system and is discharged to two Class II surface impoundments located south of Building 817. Wastewater from the chemistry buildings and photo lab rinsewaters are trucked to the clarifier/weir system for treatment prior to discharge into the surface impoundment. Explosive process waste from the machining area and pressing facility is plumbed directly to the treatment system (LLNL 2000a).

Cooling tower wastewater from various Site 300 operations is currently discharged in accordance with prescribed permit conditions to septic systems, the sewage evaporation and percolation ponds, engineered percolation systems, or in a manner that otherwise percolates into the ground. Wastewater from mechanical equipment, other than cooling towers, is discharged to septic systems, the sewage evaporation and percolation ponds, and engineered percolation systems. Wastewater generated at the contained firing facility is evaporated. Other industrial wastewater generated at Site 300 is stored in retention tanks, drummed, and hauled to the Livermore Site for reprocessing and/or disposal (LLNL 2000a).

4.14.5 Resource Conservation and Waste Minimization

Livermore Site and Site 300

Through implementation of DOE O 430.2A, DOE requires that LLNL attain the following energy usage goals:

- Reduce energy consumption per gross square foot for buildings through life-cycle cost-effective measures by 40 percent by 2005 and 45 percent by 2010, using a 1985 baseline.
- Reduce energy consumption per gross square foot (or other unit as applicable) for laboratory and industrial facilities through life-cycle cost-effective measures by 20 percent by 2005 and 30 percent by 2010, using a 1990 baseline.
- Increase the purchase of electricity from nonhydroelectric renewable energy sources by including provisions for such purchases as a component in all future DOE competitive solicitations for electricity. DOE will purchase 3 percent of its total electricity needs from nonhydroelectric renewable energy sources by 2005 and 7.5 percent of its total from nonhydroelectric renewable energy sources by 2010. Nonhydroelectric renewable energy is energy generated from solar, geothermal, biomass, or wind technologies.
- Increase the purchase of electricity from less greenhouse gas-intensive sources, including, but not limited to, new advanced technology fossil energy systems and other highly efficient generating technologies.
- Retrofit or replace all chillers greater than 150 tons of cooling capacity and manufactured before 1984 that use Class I refrigerant by 2005.
- Reduce greenhouse gas emissions attributed to facility energy use through life-cycle cost-effective measures by 25 percent by 2005 and 30 percent by 2010, using 1990 as a baseline. Greenhouse gas emissions are carbon dioxide emissions calculated from reported energy consumption.

To achieve these goals, the Energy Management Program performs studies and conducts surveys to identify opportunities for retrofit projects to reduce energy use at LLNL. In 2002, LLNL achieved a 23 percent reduction in energy use from 1990 levels.

NNSA has mandated that LLNL will attain the following waste reduction goals:

- Reduce hazardous waste from routine operations by 90 percent by 2005, using 1993 as a baseline.
- Reduce the amount of waste in all radioactive waste streams by 80 percent by 2005, using 1993 as a baseline.
- Reduce sanitary waste from routine operations by 75 percent by 2005 and 80 percent by 2010, using a 1993 baseline.

- Recycle 45 percent of sanitary wastes from all operations by 2005 and 50 percent by 2010.
- Reduce waste resulting from cleanup, stabilization, and decommissioning activities by 10 percent on an annual basis.

In 2002, LLNL generated approximately 5,800 metric tons of routine sanitary waste, a 1 percent reduction since 1993 (LLNL 2003I). However, LLNL diverted 4,000 metric tons, or 69 percent, of its sanitary waste for recycling or reuse. Additional details regarding waste reduction are provided in Appendix O, Pollution Prevention.

Beginning in 1988, LLNL began curtailing water use by implementing several water conservation measures. The following water use limitations and/or restrictions exist at LLNL:

- Reduce landscape watering to 35 percent below 1989 levels.
- Reduce blowdown in cooling towers to minimal operable levels.
- Use reclaimed groundwater in place of potable water in cooling towers to the greatest extent possible.
- Monitor all water use to discourage waste or unnecessary use.